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COMPARATIVE ANALYSIS OF VARIOUS AUTOMATED PERIMETERS

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CERTIFICATE

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PART I

INTRODUCTION

Introduction

The visual field is that portion of space in which objects are simultaneously visible to the steadily fixating eye. It is somewhat more than one half of a hollow sphere situated before & around each eye of the observer

Visual field:

"An island hill of vision surrounded by a sea of blindness: Traquair"

Advocated by Bjerrum, Ronne, Sinclair, Walker, Traquair, Harrington, Goldmann, Friedman, Humphry, Allen robin & Mark Liberman. The hill island is oval, with a regular coastline rising abruptly from the sea, in precipitous cliffs.

These cliffs are surrounded by a sloping plateau that rises toward an eccentrically placed summit, which in turn slopes steeply upward to a needle like peak. Beside the summit, is a pit or well that extends downward to the level of the sea. This is the *blind spot.*

The limits within which an object of a certain size can be seen by the normal observer can be surveyed on the hill as a contour line and plotted on a map or chart. These are the isopters of the normal field.A thorough and complete medical history, visual acuity, a careful physical examination including confrontation perimetry are needed before a perimetry is done.

The instruments & techniques available to measure the visual fields vary from the very simple to the extremely complex. No one method is the best for all patients under all circumstances. The modern perimetrists must have the working knowledge of many methods to choose the most appropriate test for each patient.

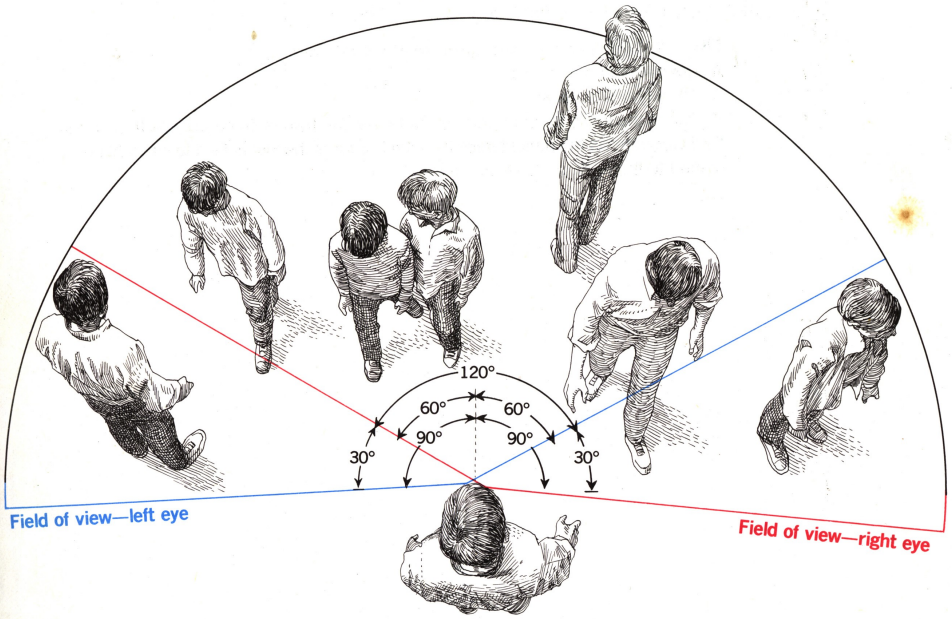

120°
60°
60°
90°
90°
30°
30°
Field of view—left eye
Field of view—right eye

FIG. 1-1

Confrontation test:

This is probably the most widely used technique by neurologists & physicians .This is a rapid screening visual field test relatively crude in method but helpful in detecting gross defects in peripheral field. The only pre-requisite required for this test is that the examiner's visual field has to be normal. Despite the above limitations, when properly performed; this may be of great value.

Manual perimeters:

Over the years, a great number of manual perimeters and perimetric techniques have been developed. During the past several decades this field has been dominated by the Tangent screen and Goldmann perimeter for clinical work and by the Tubinger perimeter for the experimental work. The other devices are:

Listers perimetry, Illuminated arc perimetry,

Harrington-flock screener, Lumiwand, Friedmann field analyser etc

Kinetic perimetry:

A stimulus is chosen and moved throughout the visual field to determine the region in which it is visible. The area with in which a given target is perceived is known as that target's isopters.

Static perimetry:

A test site is chosen and the stimulus, intensity or size is changed until it is large enough& bright enough for the patient to see it [may also start with large or bright to smaller], thus the stimulus used is stationary or static.

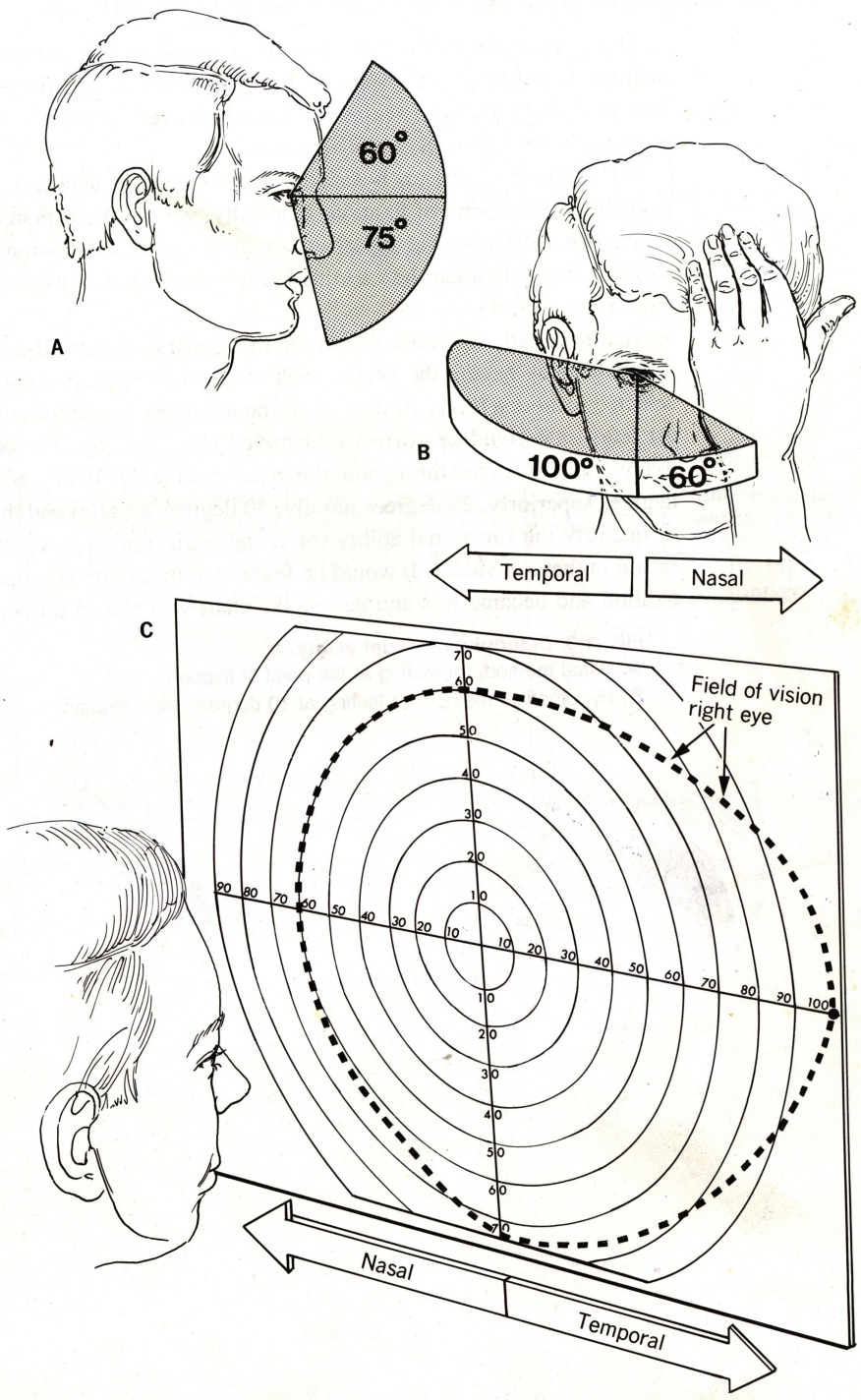

A
60°
75°
B
100°
60°
Temporal
Nasal
C
Field of vision
right eye
Nasal
Temporal

FIG. 1-2

Manual perimetry:

Mostly kinetic

Relatively large areas of the field can be traversed in a fairly short order

Can be done quickly and selected areas with more emphasis. Statokinetic dissociation

Ability to adjust target presentation, speed, and direction and location- reproducibility is a drawback

Patient and examiner are biased

Cost-effective

Automated perimetry:

Restricted areas

Mostly static

Time consuming, tedious & cumbersome

Tangent screens:

Of all the perimetric techniques, visual field examination with the tangent screen is the most flexible. Although it has its limitations, when performed properly, the tangent screen technique is capable of detecting & mapping visual field defects effectively.

General specifications:

A square piece of black felt or a soft finished cloth is required. This is stretched over a wooden frame or hung from a curtain roller fixed to the wall. It is marked by stitching in dull black thread to indicate the meridians. This may be used at varying distances of 500mm, 1mtr, and 2mtr as per the requirements.

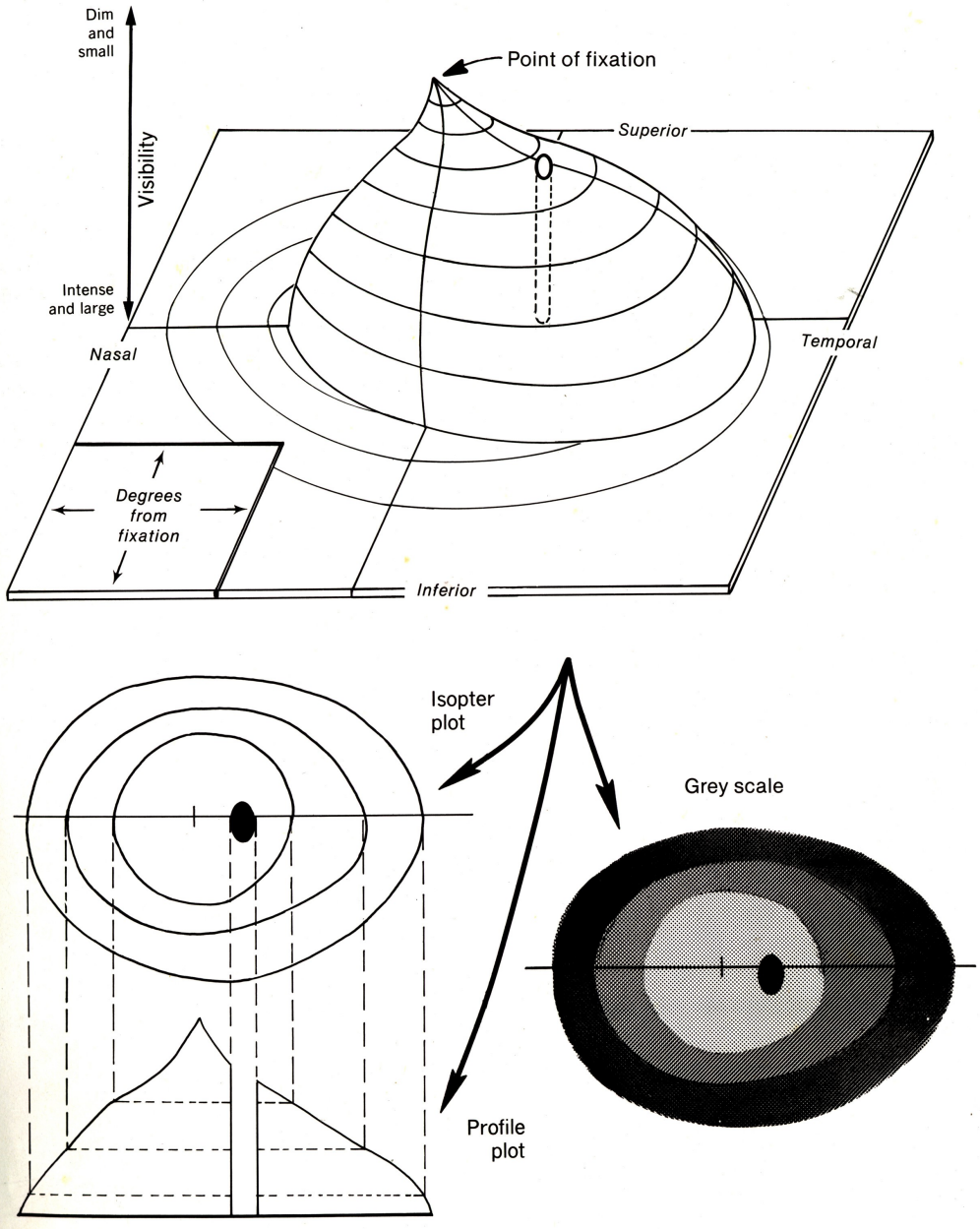

Dim
and
small
Visibility
Intense
and large
Point of fixation
Superior
Nasal
Temporal
Degrees
from
fixation
Inferior
Isopter
plot
Grey scale
Profile
plot

FIG. 1-9

Lister arc perimeter/ Projection arc perimeter:

This instrument is cost effective

It is a type of kinetic perimetry

Full field test is possible

Useful in neurological disorders

Difficult to reproduce the results

Goldmann perimeter:

Theoretically ideal perimeter

Both static & kinetic could be done

Reliable & reproducible

Time consuming

Automated computer assisted static perimeter:

Humphry, Octopus123, Humphry WDT

Fried Mann field analyzer

Visual Fields: -

Definition:

Normal visual field has been described as a “hill island of vision amidst a sea of darkness”. It is essentially an investigation of indirect vision .From the diagnostic point of view it is an extremely important investigation as no patient can be said to have received a complete ophthalmolsogic examination without investigation of visual fields. It is purely a subjective way of examination

The basic concept of structural and functional change of optic nerve is due to ganglion cell death

The hypothesis for cell death is:

Reduction in blood flow

Elevated levels of nitrate in the optic nerve

Breakdown of retinal ganglion cell survival message

As a consequence of cell death which in turn causes atrophy of the nerve fibers and other structural changes in the optic nerve the nerve fiber layer bundle defects could easily be identified and picked up by currently available visual field plotting which points out field defects

Even before the onset of clinically detectable morphological changes (NFL defects and optic nerve changes) a good perimetrist can plot typical glaucoma field defects. Hence visual field plotting especially in the central 30° of visual field is an important diagnostic tool. Field charting is not only important in diagnosing the symptom complex also helps in assessing the progression of the disease to decide the changing modality of therapy.

Visual field of one eye comprises of all the space that can see at any given instant

Normal visual field consists of:

Nasally – 60° - 65°

Temporal - 90°

Inferior - 70°

Superior - 50°

Glaucoma visual field defects:

Von Graefe was the first to describe contraction of visual field and para central scotoma. Isopters contraction was the most common field defect seen.

Among localized nerve fiber bundle defect upper visual field is more commonly involved than the lower field.

Field defects corresponding to NFL defect include:

Para central Scotoma /

Bjerrum Scotoma

Siedle scotoma

Arcuate Scotoma

Isolated Arcuate scotoma

Ronne's Nasal Step

Peripheral temporal breakthrough

Central or temporal island

Most common area of para nasal stepping defect is adjacent to superior nasal pole of blind spot. Scotomas are relative in nature in the early period but become absolute as they progress.

Implication for perimetry of visual field defect in glaucoma is

Threshold information and the most common mode of progression of scotomas in distributed

points are to be detected.

Careful delineation of area of scotoma in examination of unaffected fields is necessary as changes in these can occur as isolated signs of progression.

Research and Development

To correlate and elucidate the relation between IOP and visual field defect in various types of glaucomas

To find out type of visual field defect which is more dangerous i.e. progresses fast

Effect of various drugs on visual field progression

AUTOMATED PERIMETRY -BASICS

Automated perimetry is a type of static perimetry where the stimulus is fixed, but the size & intensity of stimulus can be varied. Goldmann perimetry came into the scenario as a gold standard for visual field testing & stayed for longer time. Now computer assisted automated perimetry are considered to be the gold standard due to their compactness & many other features.

Two main types of computer assisted static perimeters are in use.

Octopus perimeters.

Humphrey field analyzers.

PERIMETRY MEASURES:

1. ***Differential light threshold*:** Refers to ability of visual system to detect a difference in contrast between two areas of different contrast.

2. ***Apostilbs (asb)***: it is a measure of differential light threshold – measured in units of brightness per unit area.

3. ***Range of brightness available for targets is:***

On Octopus & Goldman perimeters: - 1000asb

On Humphrey field analyzers :-10,000asb

Dimmest target produced -1 asb.

4. ***Decibels:*** it is a logarithmic representation of Apostilbs brightness.

$Asb \propto 1/db$

5. ***Target size***:

I =0.25 mm s

I = 1.00mm

III=4.00mm

V = 16.00mm

V = 64.00mm

6. ***Threshold***: it is a property of target at a given retinal point the intensity of stimulus that is perceived 50% of times it is presented.

7***.*** ***Suprathreshold***: It is the dimmest target that is always seen at a given point of retina when presented.

8***.*** ***Infrathreshold:*** The brightest target that always not seen / missed at a given point of retina when presented.

*9****.*** ***Sensitivity***: It is the property of retina measured by determining the threshold. It is invariably related to threshold sensitivity.

Sensitivity ∝1/threshold

Macular sensitivity: - 31 asb.

Periphery: - 26 asb.

On an average every perimetric test constitutes a testing of 72 points.

VISUAL FIELD INDICES

*1.****Mean sensitivity***: It is the average threshold value of all the test locations in a single visual field.

It is useful in detecting the diffuse changes.

2. ***Total loss***: It is the sum of the difference between age corrected normal value & measured threshold for each location.

It reflects local / diffuse changes in visual fields.

3. ***Mean defect***: Average difference between ages corrected value & measured test value at each location.

It is sensitive to generalized depression.

4. ***Short term fluctuation*****: -** It is measure of the variability of the patients response during a single visual field testing .It is tested by testing 10 locations twice with full threshold.

5. ***Loss variance***: It shows uniformity of visual field with respect to Hill of vision. Any localized defects are highlighted. Specific for glaucomatous field defects excluding depressions due to media opacities.

6. ***Corrected loss variance***: measures the local non-uniformity of the visual field corrected for short term fluctuation. I.e. intratest variability.

7. ***Pattern standard deviation*****:** (PSD) It is a measure of the uniformity of the visual field determined by comparing the visual field of patient with age matched reference.

8. ***Corrected pattern standard deviation:*** (CPSD) it is a measure of uniformity of the visual field determined by comparing the visual field of patient with age matched reference after correcting for short term fluctuation

Loss variance &corrected loss variance is used in Octopus perimeters &its counterpart in Humphrey is PSD & CPSD.

INDICES OF PATIENT RELIABILITY:

False positive responses: Patient responding to target which is not there – patients responds to the auditory clue.

False negative response: Occurs when patient fails to respond to a maximally Suprathreshold stimuli

Fixation loss: normally 20 to 30% in a single test patient responding to target placed in blind spot.

Methods of checking fixation loss:

Fixation control:

Eye movement sensors – through infrared rays.

Close circuit TV – infra red camera catches picture of eye and projects on to operators

video

Blind spot technique: (Heijl- Krakau method): suprathreshold stimulus is projected onto blind spot patient should not respond to this, done after every 8 – 12 stimulus.

BASIC DESIGN OF COMPUTER ASSISTED AUTOMATED PERIMETRY

Stimulus source

Fixation control

Data storage

Testing strategies

STIMULUS SOURCE

Projecting system: (Goldman Perimeter)

LED – light emitting diodes

Video monitor patient fixates on pseudo infinite target

Fixation Control:

Blind spot technique

Eye movement tracing

Closed circuit TV

Data storage:

Hard Disk storage

Floppy Drive storage

TESTING STRATEGIES:

Suprathreshold Screening

Threshold Related Screening

Full Threshold Screening

SUPRATHRESHOLD STRATEGIES:

Each stimulus presented is intense enough to be seen easily by nearly all normal subjects Same level used across all over

Excludes gross pathology

Role confined to gross screening camps

THRESHOLD RELATED SCREENING:

Threshold related screening varies the intensity of the test object at different points through out the field. All stimuli are suprathreshold but the intensity of stimuli presented at a given point is related to normal threshold at the particular site.

Once a scotoma is detected, the computer follows either ZONE LEVEL TESTING or SPATIALLY ADAPTED TESTING

ZONE LEVEL TESTING

Missed point is retested with brighter stimuli – to indicate if scotoma is relative or absolute

SPATIALLY ADAPTED TESTING

Missed point is surrounded by additional test point to determine the extent of field defect.

FULL THRESHOLD DETERMINATION

Most accurate and most time-consuming way to evaluate the visual field. It determines the visual sensitivity at each and every point tested.

Mode of testing – Repetitive Bracketing / Stair case procedure

Repetitive bracketing:

A stimulus is presented at a given point

If patient sees the stimulus, the intensity is dimmed in brackets of 4db till it is not seen by the patient

Then the process is reversed i.e. intensity is increased in brackets of 2db until stimulus is seen

If patient does not see the stimulus, the intensity is increased in brackets of 4db till he sees the stimulus

Then the process is reversed i.e. intensity is decreased in brackets of 2db till patient stops seeing

Depending on brightest target not seen and dimmest target seen – Infrathreshold and suprathreshold determined

Average of these two is taken as threshold.

VARIABLES OF VISUAL FIELD TESTING

Age: increased age is associated with increased variability

Patient reliability:

Patient should be comfortable

Should be sound in mental status

Decreased learning curve effect

Patient should be mentally prepared for the test and shown a running screen programme before test so that learning curve timing is reduced

Ocular variables:

Pupil Size: Pupil size <3mm can cause generalized depression. Ideal is 3mm

b. Media opacities can cause localised / generalized depression of visual field

- Corneal opacity – localized defect seen

- Cataract: generalized defect seen – should be correlated with visual acuity

c. Refractive Correction: proper correction of refractive error is necessary to avoid reduced mean sensitivity including presbyopia.In octopus no correction for myopia required.

4. Testing variables: Technician, intertechnician and intratechnician variability

5. Background illumination:

The level of background illumination affects the contour of hill of vision and thus the appearance of visual field

Brighter background illumination increases the slope of central field

Standard background illumination – 31.5asb

6. Stimulus size and intensity:

Same stimuli should be used in every testing increased size and intensity of stimulus decreased sensitivity

Standard size of stimulus Goldmann III

7. Stimulus exposure time:

Octopus 100msec

Humphrey 200 msec

Temporal summation effect- It is ability of visual apparatus to accumulate information over time

Area of Testing: same region of visual field should be tested in serial examinations

DO'S AND DON'T'S OF VISUAL FIELD TESTING

Do's

Patient should be comfortable and in sound mental status

Pupil diameter 3mm average

Refractive correction should be given along with presbyopic correction

Proper preparation of patient by running screen test before starting actual test to reduce learning curve effect time

Room should be of medium illumination

In serial testing, the parameter should be of previous test

In case of media opacities visual acuity recorded and correlated

Don'ts

Irritable subjects should be avoided

Miotics, mydriatics and anaesthetics should be avoided

Lens rim artifact should be avoided by proper centering of lenses

Directly taking the patient for the test without acclimatization

Too bright illumination effects the result

Avoid instillation of any kind of drops/ ointment before testing

Avoid fatigue

Testing during illness/ hangover/ anxiety should be avoided

Preparing the patient

Before starting the test

Patient should be in a relaxed state

Explained about the test to the patient with procedure details

Preparation for learning curve effect done before hand

Patient should be properly seated with chin at chinrest position

Disposable linen and tissue used to clean head and chin rest

Test to be started after ascertaining patient comfort ability and getting consent from the patient

PROCEDURE

The patient is seated with his head at the center of an illuminated hemisphere or screens an appropriate corrective lens for near and distant vision placed in front of eye to be examined. Other eye occluded. Patient instructed to maintain constant fixation and asked to press the button when he sees light stimulus

Examiner constantly ascertains that fixation is maintained and instructs patient accordingly

Most common field examined - central 30°

Most common programs used – 30-1/30-2

OCTOPUS PERIMETERES

EVOLUTION: octopus –500,2000

Octopus –201

Octopus –123

VISUAL TESTING BY OCTOPUS

Octopus –326, 300,301.

Octopus =-123 uses rear projection system on a flat screen. Patient sees the light coming from an infinite distance. No correction for myopia required.

Fixation control: Infra red photograph of pupil is recorded in the memory of the computer & keeps on tracking every time. If fixation loss is present, the machine disregards that particular point test and retests later on again.

1. Screening tests: -

Commonly used programs are #03 & #07 for screening.

Age matched field profile is retrieved from the data & 6 dB brighter stimulus projected. Spatially adaptive & Zone level testing is done if any scotoma is detected in order to find out the extent of scotoma & define relative/absolute scotoma.

2. Threshold strategies: -

Commonly used tests are Program no: 30 & 32 which tests the central 30° with a 6° & 3° spacing starting at macula.

Test pattern for diagnostic programmes —G1 test for glaucoma.

G1 test for glaucoma:

This program concentrates test points in the central field, arcuate region, & in nasal mid periphery. Each area is tested with different a density & spacing of points.

3. *Threshold strategies*:-

Program #31& #33. Represents normal & fast testing strategies.

With repetitive bracketing /staircase procedure. i.e.

Initially 5db age matched suprathreshold stimulus presented. If the patient responds –YES then,

4-dB intensity decreased in brackets till patient says NO.

Then it is reversed in brackets of 2db till patients say YES.

The average of two points is taken as threshold.

If patient says no to the initial stimulus then,

Intensity is increased in 4db brackets till patient says YES.

Then it is reversed in brackets of 2db till patient says NO.

Average of two points is taken as threshold for that patient at that particular location

DIAGNOSTIC PROGRAMES IN OCTOPUS:

G 1 – programme was specifically used for testing patients with confirmed glaucoma/glaucoma suspects.

#32 commonly used.

PHASES & STAGES. -

A phase is defined as a segment of visual field test in which each test point is measured.

G1 programme has two phases.

Phase-I & phase II both phases test total of 56 points

Phase –I tests each location only once.

Short-term fluctuation is not determined.

Only Loss variance can be determined.

Corrected loss variance cannot be determined.

G1x : -This is modification of G1 programme where test interruption after phase I is done.

Used for fast interpretation of otherwise normal/suspected patients.

STAGES: - Each phase is divided into 4 stages.

Stage I – Tests 16 points – 60% sensitivity.

Stage II -Tests 16 points –80% sensitivity.

Stage III – Tests 12 points –90% sensitivity.

Stage IV – tests 14 points – 95% sensitivity.

COMPONENTS OF OCTOPUS 1-2-3 PRINTOUTS:

Patient Data:

Consists of:

Patients name, age; sex; date of birth; pupil size; refractive correction. Visual acuity. OS/OD; strategy & programe used, fixation loss; false positives & false negatives.

Gray scale:

This is a crude representation of visual field defect. Defective area is represented by darker shades.It is of importance only to explain to the patients.

Numerical data:

This consists of the patient's threshold values at each test location tested.

Bebie curve:

Also known as *cumulative defective curve.* This consists of a graphical representation of a field defect. If in between 2SD ,it is taken as normal. It helps the examiner to assess over all condition of visual field at a glance.

Numerical difference scale:

This consists of the difference between age matched values and the patient's threshold values at each test locations. Represented by figures / */+/.♦& O

Global Indices:

Mean sensitivity:

It is the average threshold value of all the test locations in a single visual field.

It is useful in detecting the diffuse changes.

Total loss :-

It is the sum of the difference between age corrected normal value & measured threshold for each location.It reflects local / diffuse changes in visual fields.

Mean defect:

Average difference between age corrected value & measure test value at each location.It is sensitive to generalised depression.

Short term fluctuation:-

It is measure of the variability of the patients response during a single visual field .corrected for short term fluctuation.

Loss variance: It shows uniformity of visual field with respect to Hill of vision. Any localized defects are highlighted. But without correction for SF.

Corrected loss variance: This measures the local non-uniformity of the visual field corrected for short term fluctuation.

HUMPHREY FIELD ANALYSER

Humphrey field analyzer consists of a single unit rectangular instrument containing bowl dish 33cm from Eye.Video panel with projection type of stimulus source.

FIXATION:

Heijl krakau method; suprathreshold stimulus is projected onto the blind spot; if the patient responds it is regarded as fixation loss.

HUMPHREY FIELD ANALYSER BASICS:

Three basic categories of visual field tests available.

Screening tests.

threshold tests

Custom test

Screening tests: -

Test patterns:-

A) 5 tests exploring central 30°

B) 5 tests exploring 55°

VISUAL FIELD TESTING BY HFA II

C) One focal examination along mid periphery.

D) Hybrid screening automated diagnostic test.

Central tests: Armaly central examination concentrates on 84 tests points.

***Screening strategies*:**

Threshold related - 5db suprathreshold stimulus given at a particular location

Three zone testing :- If stimulus is missed twice it is again tested twice.

Quantify defects.

Suprathreshold single intensity test

Screening parameters*:*

Size of the target –Goldman size III

Colour-white.

Fixation target-Small/large diamond shaped comprising of yellow lights.

AUTOMATIC DIAGNOSTIC TESTS -

Modified form of screening test pattern

-Suitable for evaluating low risk ocular hypertensive patients.

-Uses 88 points of threshold related strategies.

-If patient misses twice automatically test proceeds to Phase II.

-Phase II – Quantify defect strategy: - it explores missed points and surrounding the missed area with extra points. Like spatially adaptive technique.

Threshold examination: central 30-2 most frequently used test pattern.

30-1 –Indicates central 30° being tested without thresholding of blind spot.

30-2—Indicates central 30° being tested with thresholding of blind spot.

- Checks test points in linear pattern. Total of 76 points with 6° spacing used.
- Vertical & horizontal straddling done.
- Inner most point 3° from fixation.

HIGH RESOLUTION- central 10-2 test pattern. 68 points spaced 2°apart are checked . This is of considerable value in eyes with – split fixation &advance disease.

Threshold strategy:

Initialization done with 4 primary points. Depending upon patient's response to primary points bracketing strategy started & threshold value for that point determined and then moved to adjacent points.

COMPONENTS OF HUMPHREY FIELD ANALYSER

Patient's data*:*

Includes: - name; age; sex; DOB; Pupil diameter; test pattern; strategy; V/A; OD/OS; Stimulus size and colour, back ground illumination.

Reliability criteria:

Includes –Fixation monitor; fixation target; fixation losses; False positives; False negatives, test duration and coefficient.

Grey scale:

Gives impression of gross defect in a particular area by shade. Mainly useful for the purpose of patient demonstration.

Total deviation plot:

It represents point by point representation of patient threshold from expected age corrected normals.Total deviation draws attention towards the "over all sinking of hill of vision." This is caused by media opacities; refractive errors, miosis.

Pattern deviation plot*:*

This adjusts the value of total deviation from corresponding to media opacities , refractive errors and attention is drawn towards localized scotomas.

GLOBAL INDICES:

Mean sensitivity:

It is the average threshold value of all the test locations in a single visual field.

It is useful in detecting the diffuse changes.

Total loss:

It is the sum of the difference between the age corrected normal value and the measured threshold for each location.It reflects local / diffuse changes in visual fields.

Mean defect:

Average difference between age corrected value and the measured test value at each location.It is sensitive to generalized depression.

Short term fluctuation:

It is measure of the variability of the patient's response during a single visual field.

Pattern standard deviation:

It is a measure of the uniformity of the visual field determined by comparing the visual field of patient with age matched reference.

6. ***Corrected pattern standard deviation:***

It is a measure of the uniformity of the visual field determined by comparing the visual field of the patient with age matched reference after correcting for short term fluctuation .Short-term fluctuation tests 10 points with double threshold.

7***. Glaucoma hemifield test:***

In this test, five sectors in upper fields are compared with mirror images in the lower field.

8***. Numerical scale:***

This shows the actual threshold value of patient tested at each location.

FEW MODIFIED PERIMETRIC STRATEGIES

SITA standard & SITA fast

Swedish Interactive Threshold Algorithm:

This is a type of white on white perimetry

SITA standard; matches the full threshold strategy and at the same time reducing the time to half.

SITA & SITA fast save time by:

Interpretation mainly depends mainly on PSD.

SF & CPSD is not calculated. So time for double thresholding of 10 points in calculating SF is eliminated . Time gap between each presentation is reduced.

Test is started on each location with a better estimate.

Time spent on catch trials is reduced.

All these features are incorporated in Humphrey field analyzer.

Blue on yellow perimetry:

SWAP: -***Short wavelength automated perimetry***.

Advantage of SWAP is that it detects glaucomatous visual field defects much earlier than the white on white perimetry.

It uses blue stimuli. (440 nm,)narrow band. & Target of 1.8°. Projected on bright yellow background of 530nm.

Drawback of SWAP is –test time is of 15 min and the test results are influenced by the presence of cataract.

TENDENCY ORIENTED PERIMETRY: - TOP

This is the counter part of SITA enabled for octopus perimeters.

Uses staircase procedure by sequentially evaluating neighboring locations

Each location is tested only once. Total visual field is divided into squares of neighboring locations.Each square is tested with relative neighboring threshold.Thus saving time.

TOP is four times faster than the conventional stair case procedure.

GLAUCOMA HEMIFIELD TEST:

It compares mirror values of 5 clusters of points in superior Vs inferior arcuate regions.

It is of value in assessing glaucoma suspects.

Comes with statpac-2 HFA.

Frequency Doubling technology Perimetry

Frequency Doubling Theory: -

The human retina has approximately 1.2- to 1.5 million neurons (also called retinal ganglion cell axons or nerve fibers) that bundle together to comprise the optic nerve. The irreversible loss of these retinal nerve fibers occurs in glaucoma and other ocular conditions, associated with the classic gradual increase in optic nerve "cup" size over time. Some studies have suggested that up to 40 percent of these retinal nerve fibers could die before any notable visual field loss is found, so that the patient may be unaware of any visual problem. It may take an average of 4-6 years of gradual nerve fiber loss before varied amounts and patterns of glaucomatous visual field loss become apparent.

Retinal nerve fibers can be simply classified into two main types that transmit signals from the retinal receptor cells by way of the optic nerve to the lateral geniculate body

VISUAL FIELD TESTING BY FDT

and ultimately to the visual cortex. These are the Magno-cellular (or M) cells, and the parvo-cellular (or P) cells.

The M-cell pathway is responsible for low-contrast, high temporal frequency (or motion) stimulus detection. For example, a black car rapidly passing by a driver's side window at night may stimulate the driver's M-cell neurons. The P-cell pathway is responsible for high-contrast, low temporal frequency (or static) stimulus detection. An example would be a patient attempting to read the smallest letters possible on a standard projected snellen eye chart.

The larger diameter M-cell neurons constitute approximately 10% of the total number of retinal nerve fibers. Moreover, My ganglion cells, a subset of approximately 15 to 25% of M cells exhibit nonlinear response properties. On the basis of these characteristics, testing visual functions mediated by My ganglion cells may permit early detection of visual functional losses in glaucoma.

When a low spatial frequency sinusoidal grating with alternating wide light and dark bars undergoes high temporal-frequency counterphase flicker, (i.e., the black bands reverse to become white and the white bands reverse to become black in rapid sequence the grating appears to have twice as many light/dark bars (i.e., its spatial frequency appears doubled) as shown in the example below. This phenomenon is called the frequency doubling illusion.

It is the vulnerable "non-linear" M-cell neurons that are thought to transmit signals related to this illusion. Since the M-cell neurons tend to be among the first to die, selective testing by presenting alternate grating stimuli was developed to attempt to identify earlier retinal neuron loss that by traditional automated perimetry. This resulted in development of the Frequency Doubling Technology (or FDT) perimeter by Humphrey / Welch-Allyn / Zeiss.

Frequency Doubling Technology:

The Frequency Doubling Technology perimeter is a portable device that specifically tests for visual field loss due to non-linear M-cell neuron death, typically from glaucoma. Since this instrument targets a specific sub-set of nerve fibers that transmits larger, low-contrast, motion-based stimuli rather than detailed, high-contrast static stimuli. FDT perimetry will tolerate up to 6 diopters of blur and is not affected by external room illumination or variations in the pupil size, so long as the pupil diameter is greater than 2mm.

The device is relatively easy to use with a series of menu screens that allow selection of the test to be conducted (e.g. screening vs threshold), age of the patient, report printing, etc. Instructions to the patient are also quite simple, to look at a black dot in the center of the screen and press a button any time a grating pattern is seen. During the test, a 5-degree square pattern is presented at a total of 17 different locations within the central 20-degree by 20-degree visual field.

Test options include a screening field (screening C-20) in which 5-degree gratings, with three contrast levels are shown at 17 locations in the central 20-degree field. Results are reported based on how much contrast is required for the patient to detect the grating.

FDT screening mode perimetry is considered abnormal when the following are present:

Any defect in the central five locations

Two mild or moderate defects in the outer 12 squares

One severe defect in the outer 12 squares

Screening test time greater than 90 seconds per eye

There are also two full threshold test options: Full Threshold N-20 and Full Threshold N-30. Using these options, the FDT uses more contrast levels to search for the patient's threshold at each of the locations tested. Again, each grating is a 5 degrees square, but in the N-30 test the horizontal field tested is extended to include an extra portion of the nasal visual field, resulting in a total 30 degree horizontal field.

The sample printout below shows actual threshold levels in dB for each location tested and an age referenced deviation chart on which symbols are used to indicate how likely it is that a normal patient would have that threshold level. These probabilities are shown as p values .

INTERPRETATION OF RESULTS: -

As in cardiology interpretation of ECG holds good only when it is clinically correlated. In the same manner, the interpretation of Automated Perimetry holds good, only when it is clinically correlated with Optic nerve head changes.

Important points to be noted before interpretation is:

-Substantiate unexpected field results with clinical evaluation of retina/OpticNerve/visual pathway.

-Do not make irrevocable decisions based on a single visual field examination results. Always repeat the test.

STANDARD GEOGRAPHIC SEQUENCE OF EXAMINING THE VISUAL FIELD.

At or nearest to fixation. (To rule out split fixation.)

In the Para central & arcuate regions. (To rule out Bjerrum defects.)

Surrounding the blind spot. (To rule out Siedel scotoma.)

In the nasal step area.

In either side of Vertical & horizontal meridians. (To rule out subtle hemianopic contour.)

At the periphery to rule out temporal wedge.

Search for an isolated scotoma.

INTERPRETATION OF OCTOPUS PERIMETRY RESULTS:

Patient data:

Consists of:

Patient's name, age;sex; date of birth; pupil size; refractive correction.Visual acuity. OS/OD; Strategy & programe used., Fixation loss; false positives &false negatives.

Grey scale:

This is a crude representation of visualfield defect. Defective area is represented by darker shades.It is of importance only to explain to the patient.

Numerical data:

Consists of patient's threshold values at each test location tested.

Bebie curve:

Also known as *cumulative defective curve*.This consists of graphical representation of field defect.If in between 2SD it is taken as normal.Helps examiner to assess over all condition of visual field at a glance. If curve is showing uniform depression then it is generalized depression. If it is showing inverted L shaped defect then it indicates localized defect.

Numerical difference scale:

This consists of difference between age matched values & patient's threshold values at each test locations.

Represented by figures / */+/.♦& O

*/+ Normal threshold

♦ Absolute scotoma.

O Relative scotoma.

GLOBAL INDICES:

Mean sensitivity: It is the average threshold value of all the test locations in a single visual field.It is useful in detecting the diffuse changes.

Mean defect: Average difference between age corrected value & measured test value at each location.

If it is on positive side it is significant.

If it is "0" it is taken as normal.

If it is on negative side it shows high retinal sensitivity.

It is sensitive to generalized depression.

Short term fluctuation: - It is measure of the variability of the patient's response during a single visual

field.

Value less than 1.5 is mild

Value between1.5 to 2.5 is moderate.

Value > 2.5 shows high intra -test variability.

Values upto 2.5 are taken to be normal.

Loss variance:

It shows uniformity of visual field with respect to the Hill of vision .Any localized defects are highlighted, but without correction for SF. High Loss variance indicates localized defects pertaining to glaucoma,excluding defects due to media opacities especially dense cataracts in which mean defect values will be high.

If mean defect is high and loss variance is low –Cataract is responsible for field defect.

If mean defect is low and loss variance is high –It is a purely a glaucomatous field defect

If both are high – then both are responsible for field defects.

Corrected loss variance:

This measures the local non-uniformity of the visual field corrected for short term fluctuation.

INTERPRETATION OF HUMPHREY FIELD ANALYSER RESULTS: -

. ***Patient's data****:*

Includes; - name; age; sex; DOB; Pupil diameter; test pattern; strategy; V/A; OD/OS; Stimulus size & colour. Back ground illumination.

Reliability criteria:

Includes –Fixation monitor; fixation target; fixation losses; False positives; False negatives: test duration & Coefficient.

Grey scale:

Gives impression of gross defect in a particular area by shade. Mainly useful for the purpose of patient demonstration.

Total deviation plot:

It represents point by point representation of patient threshold from expected age corrected normals.Total deviation draws attention towards the "over all sinking of hill of vision." This is caused by media opacities; refractive errors; Miosis.

Pattern deviation plot:

This adjusts the value of total deviation corresponding to media opacities/ refractive errors &attention drawn towards localized defects.If it is high it shows pure glaucomatous field defects.

GLOBAL INDICES:

1.)Mean sensitivity:

It is the average threshold value of all the test locations in a single visual field.It is useful in detecting the diffuse changes.

2.)Total loss:

It is the sum of the difference between age corrected normal value & measured threshold for each location.It reflects local / diffuse changes in visual fields.

3.)Mean defect:

Average difference between age corrected value & measure test value at each location.

If it is on positive side it shows high retinal sensitivity.

If it is “0” it is taken as normal.

If it is on negative side it is taken to be significant.

It is sensitive to generalized depression.

4.) Short term fluctuation:

It is measure of the variability of the patient’s response during a single visual field.

5.)***Pattern standard deviation***:

It is a measure of the uniformity of the visual field determined by comparing the visual field of patient with age matched reference.

6.)Corrected pattern standard deviation:

It is a measure of the uniformity of the visual field determined by comparing the visual field of patient with age matched reference after correcting for short term fluctuation.It is the counterpart of corrected loss variance in octopus.

High values indicate towards glaucomatous field defects.

Short-term fluctuation tests 10 points with double threshold.

7.)Glaucoma hemifield test:

In this test five sectors in upper fields are compared with mirror images in the lower field.

8.)Numerical scale:

This shows the actual threshold value of patient tested at each location.

AIM OF THE STUDY

Comparison of visual field plotting in glaucoma patients with Octopus Interzeig 1-2-3, Humphrey Field Analyzer II, Frequency Doubling Technology.

METHODS AND MATERIALS

METHODS AND MATERIALS

This study was conducted in 100 eyes of 50 patients who attended the Glaucoma Clinic, RIO-GOH during the period Jan 2005 to March 2006. All the patients were randomly selected using random tables.

INCLUSION CRITERIA:-

1. Best corrected visual acuity of 6/12 or better.
2. Primary Open Angle Glaucoma.
3. Normal Tension Glaucoma.
4. Glaucoma suspect.

EXCLUSION CRITERIA:-

1. Primary Narrow Angle Glaucoma.
2. Secondary Glaucoma.
3. Patients who underwent intraocular surgeries/Laser treatment.
4. Congenital Glaucoma.
5. Ocular diseases showing similar visual field defects(glaucomatous visual field defects).

All the patients were subjected to thorough Slitlamp examination, Tension by Goldmann applanation tonometry, fundus examination by slitlamp biomicroscopy with the help of +90D lens and Gonioscopy with Goldmann Single Mirror .

Single Field Analysis

Eye: Left

Name: KARUNANIDHI.V.MR | ID: 134052 | DOB: 01-01-1958

Central 30-2 Threshold Test

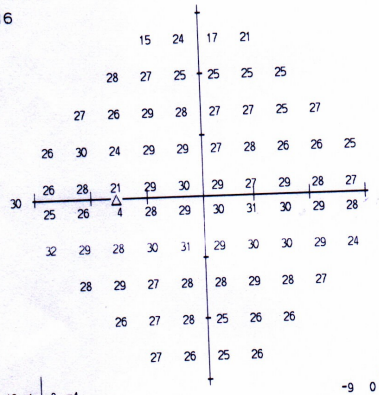
Fixation Monitor: Blindspot
Fixation Target: Central
Fixation Losses: 4/17 xx
False POS Errors: 12 %
False NEG Errors: 9 %
Test Duration: 08:16

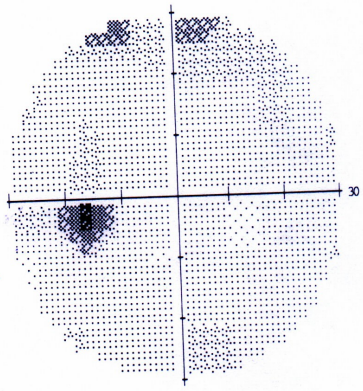
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard

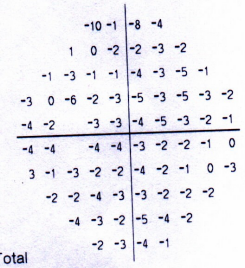
Pupil Diameter:
Visual Acuity:
RX: -3.50 DS DC X

Date: 01-06-2006
Time: 1:38 PM
Age: 48

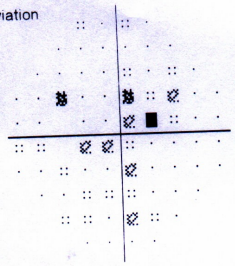
Fovea: 33 dB

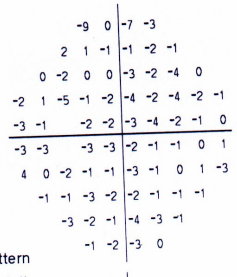




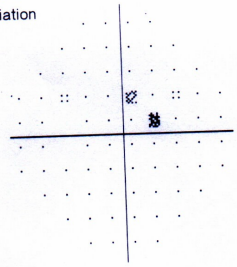


Total Deviation





Pattern Deviation



Low Patient Reliability
GHT
Within normal limits

MD -2.78 dB P < 5%
PSD 1.75 dB

:: < 5%
▨ < 2%
▩ < 1%
■ < 0.5%

TERF
VADAPALANI
CHENNAI-600 026

6/6P

HFA II 720-4312-A12.3/A12.3

Single Field Analysis

Eye: Right

Name: KARUNANIDHI.V.MR	ID: 134052	DOB: 01-01-1958

Central 30-2 Threshold Test

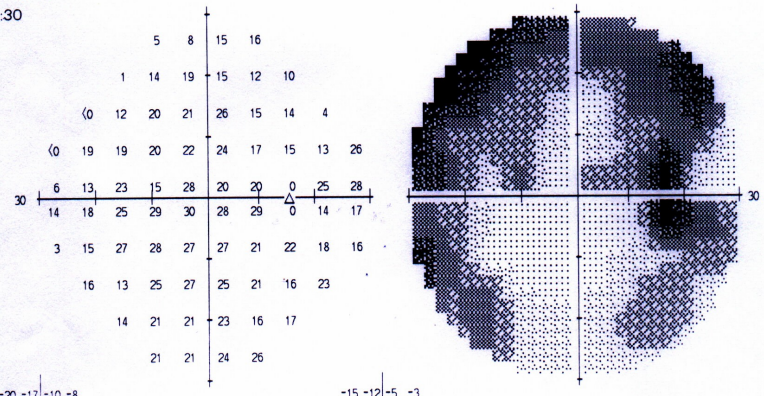
Fixation Monitor: Blindspot
Fixation Target: Central
Fixation Losses: 1/23
False POS Errors: 1 %
False NEG Errors: 11 %
Test Duration: 11:30

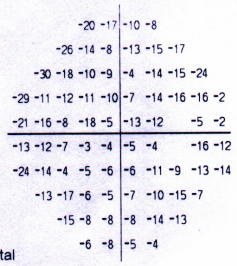
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard

Pupil Diameter:
Visual Acuity:
RX: -3.50 DS DC X

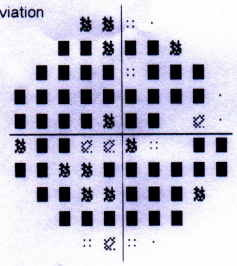
Date: 01-06-2006
Time: 1:23 PM
Age: 48

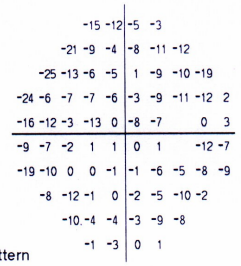
Fovea: 33 dB



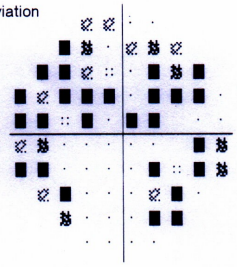


Total Deviation





Pattern Deviation



:: < 5%
⁘ < 2%
▒ < 1%
■ < 0.5%

GHT
Outside normal limits

MD -10.17 dB P < 0.5%
PSD 6.44 dB P < 0.5%

TERF
VADAPALANI
CHENNAI-600 026

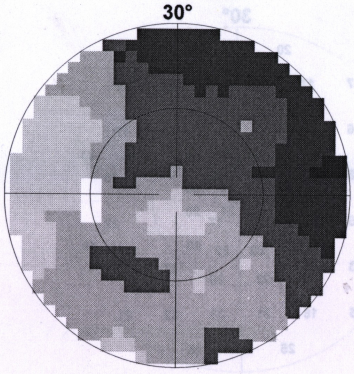
6/9

HFA II 720-4312-A12.3/A12.3

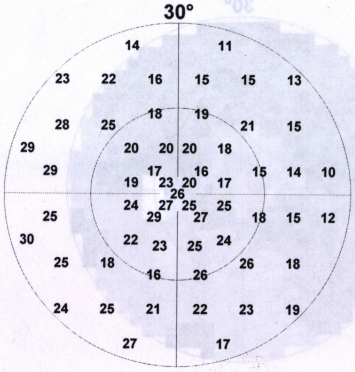
INTERZEAG OCTOPUS 1-2-3 V 6.04c Glaucoma Clinic
Seven-in-One RIO-GOH Chennai

Name:	**KARUNANIDHI**	Eye / Pupil[mm]:	**Left (OS) / 3**
First name:	V	Date / Time:	01/06/2006 08:27 AM
ID #:	2/06	Test duration:	2:19
Birthdate:	01/01/1957	Program / Code:	tG1 / 0
Age:	49	# Stages / Phases:	/ 1
Sex:	male	Strategy / Method:	TOP / Normal
Refr. S / C / A:	/ /	Test target / duration:	III / 100 ms
Acuity:	6/9	Background:	31.4 asb
IOP:	17.3	# Questions / Repetitions:	72 / 0
Diagnostics:		# Catch trials:	pos 1 / 4, neg 1 / 4
Patient file:		E:\Octopus\ExDat\DEMO.PVD	

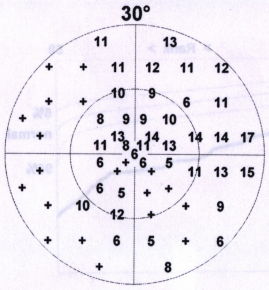
Greyscale of values



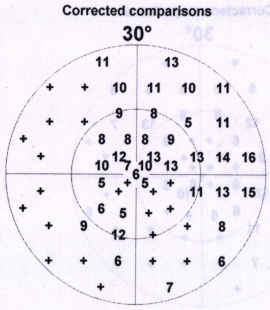
Values

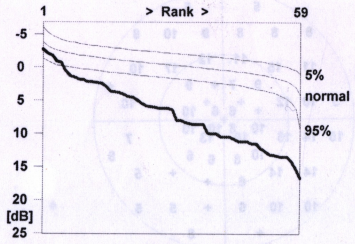


Comparisons

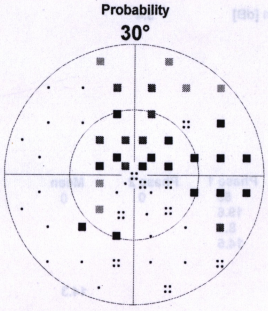


Corrected comparisons

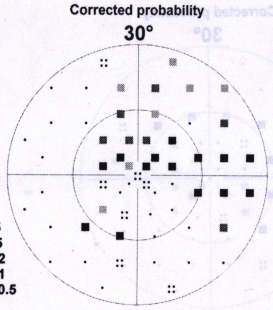




Probability



Corrected probability



· P>5
:: P<5
P<2
P<1
P<0.5

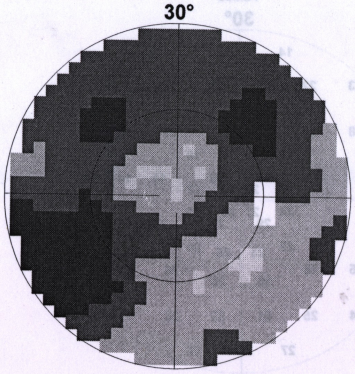
Deviation [dB] 0.6

	Phase 1	Phase 2	Mean
#	59	0	0
MS	20.8		
MD	7.0		
LV	23.5		
CLV			
SF			
RF			25.0

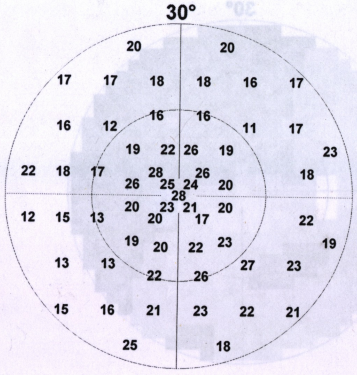
INTERZEAG OCTOPUS 1-2-3 V 6.04c Glaucoma Clinic
Seven-in-One RIO-GOH Chennai

Name:	**KARUNANIDHI**	Eye / Pupil[mm]:	**Right(OD) / 3**
First name:	V	Date / Time:	01/06/2006 08:21 AM
ID #:	2/06	Test duration:	2:17
Birthdate:	01/01/1957	Program / Code:	tG1 / 0
Age:	49	# Stages / Phases:	/ 1
Sex:	male	Strategy / Method:	TOP / Normal
Refr. S / C / A:	/ /	Test target / duration:	III / 100 ms
Acuity:	6/9	Background:	31.4 asb
IOP:	17.3	# Questions / Repetitions:	69 / 0
Diagnostics:		# Catch trials:	pos 0 / 3, neg 1 / 4
Patient file:		E:\Octopus\ExDat\DEMO.PVD	

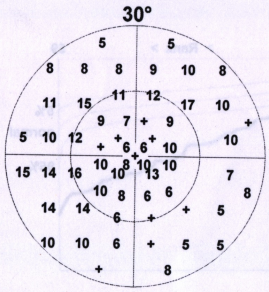
Greyscale of values



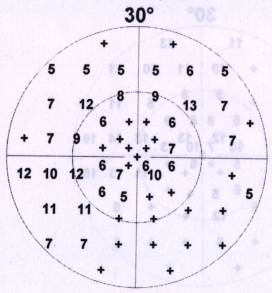
Values

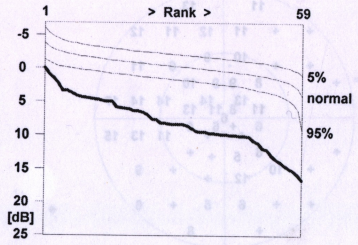


Comparisons

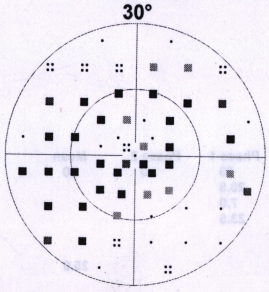


Corrected comparisons

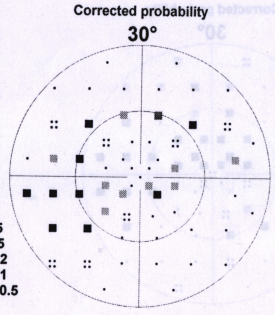




Probability



Corrected probability



Deviation [dB] 3.4

	Phase 1	Phase 2	Mean
#	59	0	0
MS	19.6		
MD	8.1		
LV	14.5		
CLV			
SF			
RF			14.3

LEFT EYE

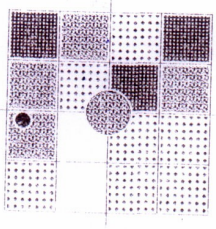
Test Duration: 05:04 min

Threshold (dB)

16	19	23	14
19	23	19	20
19	26	23	24
23	26	23	22

21

Deviation



30°

MD -6.45 dB P < 0.5%
PSD +4.04 dB

FIXATION ERRS: 0/6
FALSE POS ERRS: 0/6
FALSE NEG ERRS: 0/3

Probability Symbols

P >= 5%
P < 5%
P < 2%
P < 1%
P < 0.5%

FULL THRESHOLD C-20

NAME _____

AGE 48 ID _____

06 JAN 2006 11:41

RIGHT EYE

Test Duration: 05:36 min

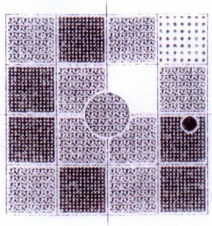
Threshold (dB)

18	7	18	22
15	21	27	17
9	19	21	15
17	13	20	2

20

Deviation

30°



MD -10.31 dB P < 0.5%
PSD +7.82 dB P < 2%

FIXATION ERRS: 0/6
FALSE POS ERRS: 0/6
FALSE NEG ERRS: 1/3

Welch Allyn™
FREQUENCY DOUBLING TECHNOLOGY

HUMPHREY INSTRUMENTS

All the patients underwent visual field examinations by Octopus Interzeig 1-2-3 TOP, Humphrey field Analyzer II Central 30-2 threshold test(SITA-Standard) and Full threshold C-20 by Frequency Doubling Technology (Zeiss Humphrey systems and Welch Allyn) full threshold test within a period of one week by trained personnel.

The global indices of each perimetry were analysed. The indices namely Mean Deviation and Loss Variance/ Pattern Standard Deviation of both eyes were compared and correlated between these three Perimeters(Ie Octopus Vs Humphrey, Humphrey Vs Frequency Doubling Technique and Octopus Vs Frequency Doubling Technique) using the Pearson correlation and Scatter diagram with regression estimate. Linear regression analysis was used to calculate the correlation coefficients. Statistical comparisons between groups used unpaired 2-tailed t- test.

The average time taken to perform each test was analyzed.

RESULTS

RESULTS:-

RIGHT EYE:

MEAN DEVIATON:-

Octopus Mean Deviation significantly and negatively correlated with Humphrey and Frequency Doubling Technology Perimetry. Similarly Humphrey Mean Deviation significantly and positively correlated with Frequency Doubling Technology Perimetry.

1. O-MD Vs H-MD: r = - 0.520, p<0.001
2. O-MD Vs F-MD: r = -0.723,p<0.001
3. H-MD Vs F-MD: r = 0.628, p<0.001

Correlations

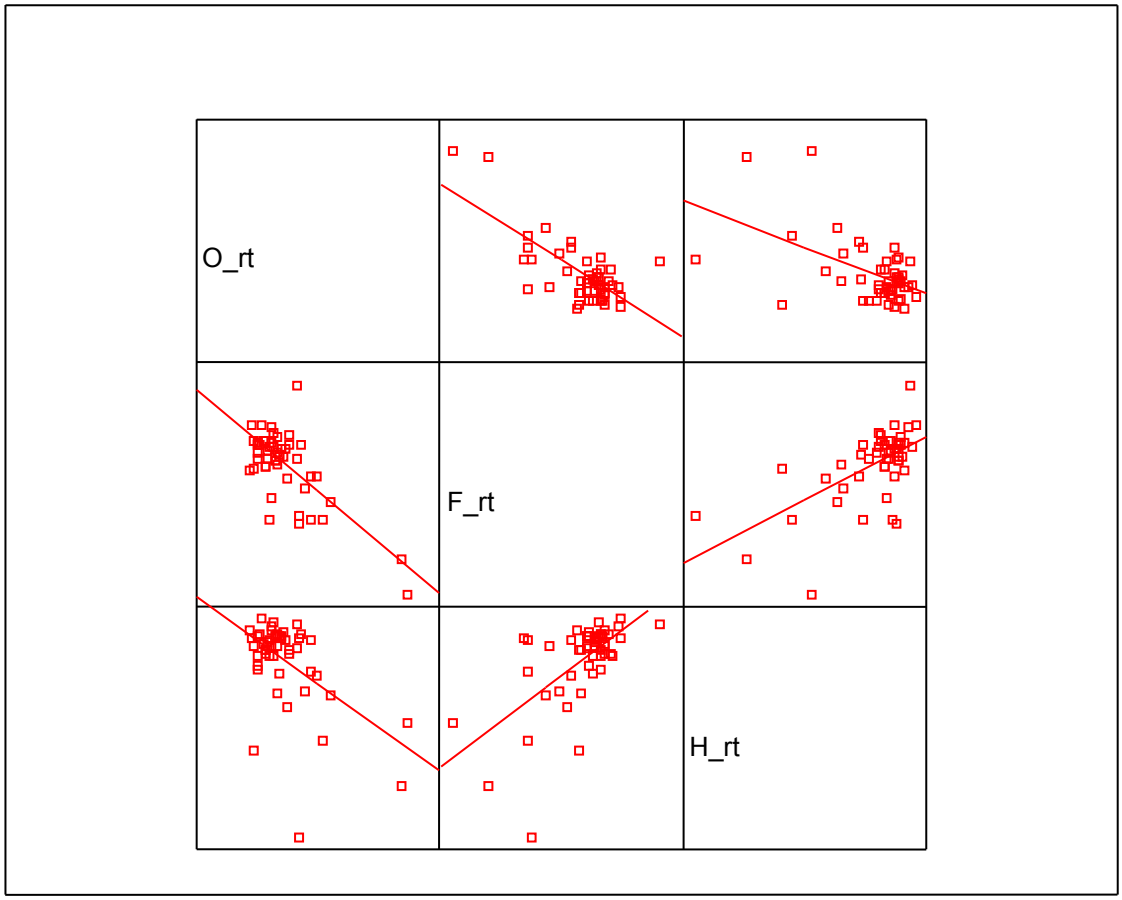
		O_rt	F_rt	H_rt
	Pearson Correlation	1	-.723(**)	-.526(**)
	Sig. (2-tailed)	.	.001	.001
	N	50	50	50
	Pearson Correlation	-.723(**)	1	.628(**)
	Sig. (2-tailed)	.001	.	.001
	N	50	50	50
	Pearson Correlation	-.526(**)	.628(**)	1
	Sig. (2-tailed)	.001	.001	.
	N	50	50	50

** Correlation is significant at the 0.01 level (2-tailed).

LOSS VARIANCE/PATTERN STANDARD DEVIATION:-

Octopus loss variance significantly and positively correlated with pattern standard deviation of Humphrey and Frequency Doubling Technology Perimetry. Similarly

CORRELATION MATRIX OF RE MD



Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.895	.869		-4.480	.000
	O_rt	-.543	.127	-.526	-4.283	.000

a Dependent Variable: H_rt

Y= - 3.895 + 0.526X, r = 0.526, p < 0.001, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.537	.755		.712	.480
	F_rt	-.626	.086	-.723	-7.240	.000

a Dependent Variable: O_rt

Y = 0.537 – 0.626X, r = - 0.723, p<0.001, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.761	.877		-3.147	.003
	F_rt	.562	.101	.628	5.592	.000

a Dependent Variable: H_rt

Y=-2.761+.626X,r=-0.628,p<0.001,n=50

Humphrey Pattern standard deviation significantly and positively correlated with Frequency Doubling Technology Perimetry.

1. O-LV Vs H- PSD: r = 0.312 p<0.002
2. O-LV Vs F-PSD: r = 0.283 p<0.05
3. H-PSD Vs F-PSD: r = 0.427,p<0.002.

Correlations

		O1_rt	FR1_rt	HR1_rt
O1_rt	Pearson Correlation	1	.283	.312
	Sig. (2-tailed)	.	.05(*)	.002
	N	50	50	50
FR1_rt	Pearson Correlation	.283	1	.427(**)
	Sig. (2-tailed)	.05(*)	.	.002
	N	50	50	50
HR1_rt	Pearson Correlation	.312	.427(**)	1
	Sig. (2-tailed)	.002	.002	.
	N	50	50	50

** Correlation is significant at the 0.01 level (2-tailed).

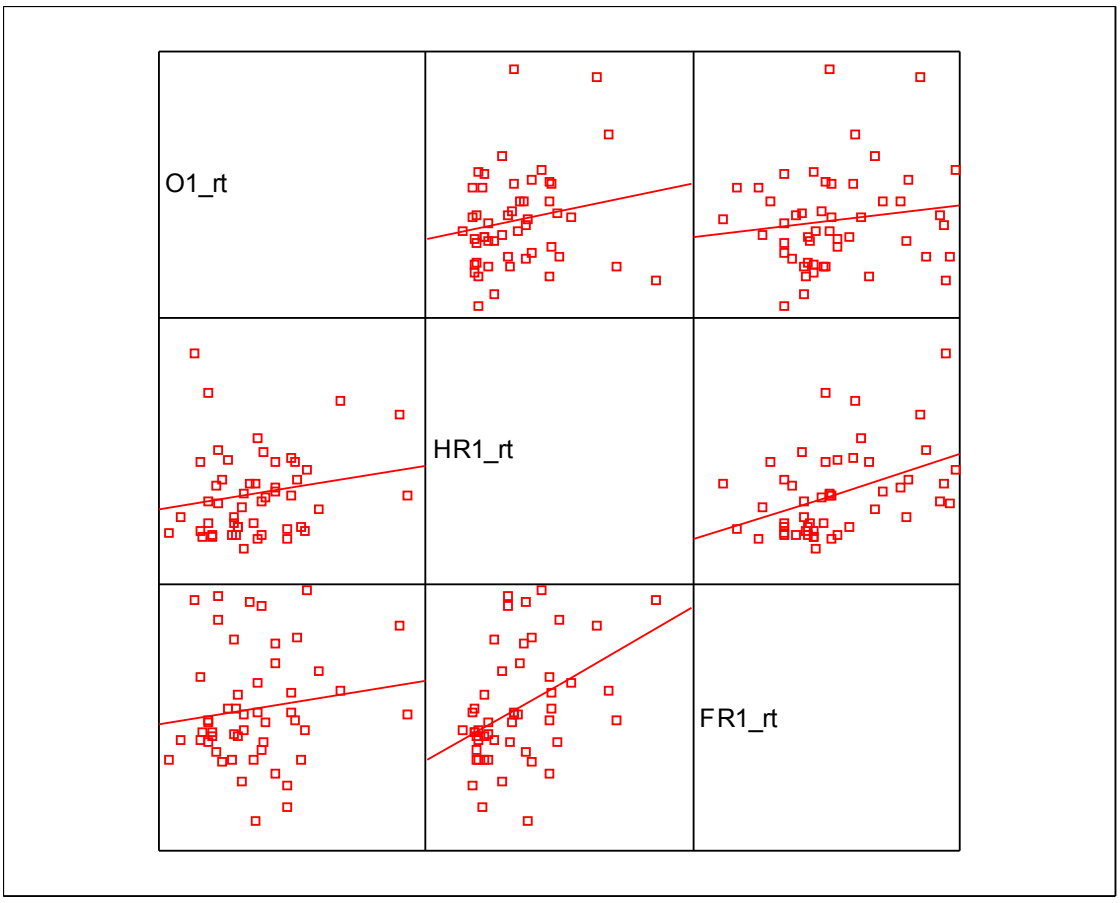
LEFT EYE:-

MEAN DEVIATON:-

Octopus Mean Deviation significantly and negatively correlated with Humphrey and Frequency Doubling Technology Perimetry. Similarly Humphrey Mean Deviation significantly and positively correlated with Frequency Doubling Technology Perimetry.

4. O-MD Vs H-MD: $r = -0.581$, $p<0.001$
5. O-MD Vs F-MD: $r = -0.648$, $p<0.001$
6. H-MD Vs F-MD: $r = 0.683$, $p<0.001$

CORRELATION MATRIX OF RE LV/PSD



Coefficients(a)

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.

		B	Std. Error	Beta		
1	(Constant)	4.530	1.356		3.340	.002
	FR1_rt	.237	.243	.283	.975	.335

a Dependent Variable: O1_rt

Y = 4.53+ 0.237X, r = 0.283, p<0.05, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.311	.675		1.942	.058
	FR1_rt	.396	.121	.427	3.270	.002

a Dependent Variable: HR1_rt

Y = 1.311+ 0.396X, r = 0.427, p<0.002, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.839	.501		5.666	.000
	O1_rt	.099	.077	.283	1.282	.206

a Dependent Variable: HR1_rt

Y = 2.839 + 0.099X, r = - 0.283, p<0.002, n= 50

Correlations

		O_lt	F_lt	H_lt
	Pearson Correlation	1	-.648(**)	-.580(**)
	Sig. (2-tailed)	.	.001	.001
	N	50	50	50
	Pearson Correlation	-.648(**)	1	.683(**)
	Sig. (2-tailed)	.001	.	.001
	N	50	50	50
	Pearson Correlation	-.580(**)	.683(**)	1
	Sig. (2-tailed)	.001	.001	.
	N	50	50	50

** Correlation is significant at the 0.01 level (2-tailed).

LOSS VARIANCE/PATTERN STANDARD DEVIATION:-

Octopus loss variance significantly and positively correlated with pattern standard deviation of Humphrey and Frequency Doubling Technology Perimetry. Similarly Humphrey Pattern standard deviation significantly and positively correlated with Frequency Doubling Technology Perimetry.

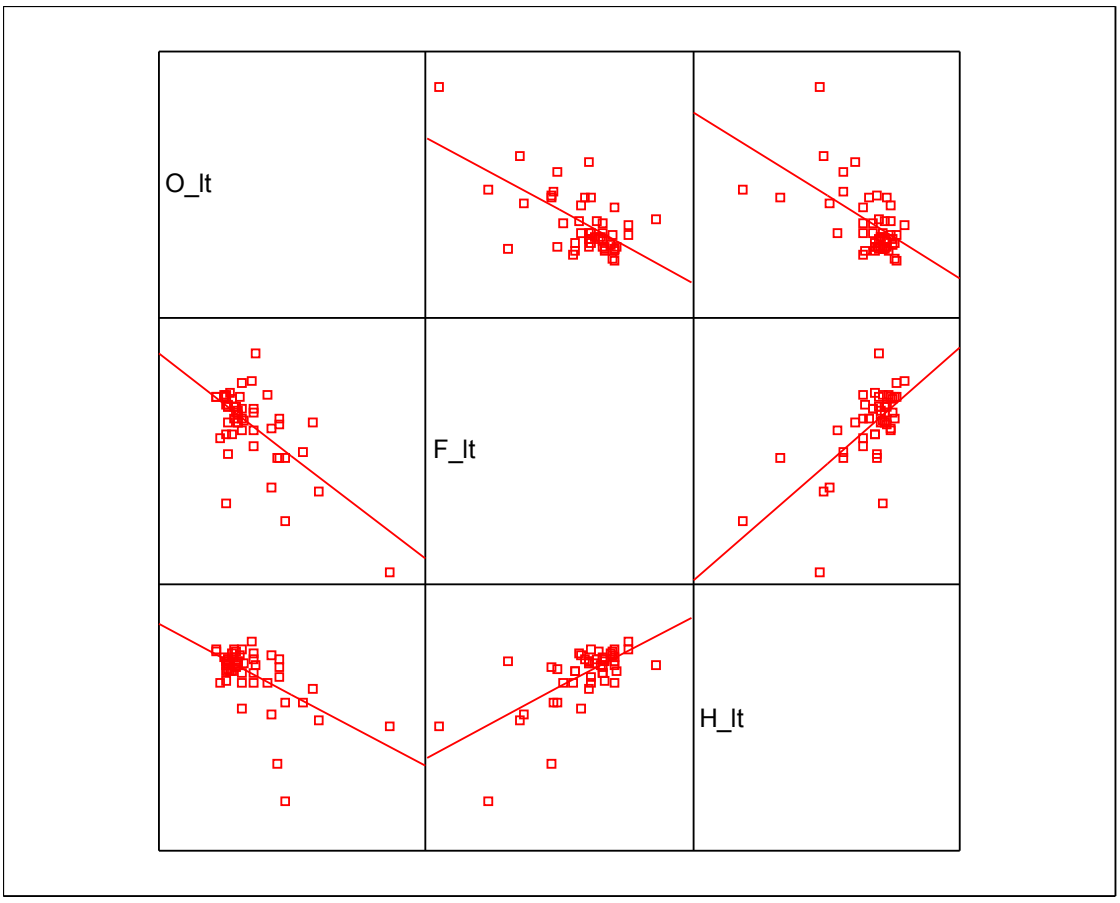
1. O-LV Vs H- PSD: $r = 0.544$, $p<0.001$
2. O-LV Vs F-PSD: $r = 0.568$, $p<0.001$
3. H-PSD Vs F-PSD: $r = 0.650$, $p<0.001$.

Correlations

		O1_lt	HR1_lt	FR1_lt
	Pearson Correlation	1	.544(**)	.568(**)
	Sig. (2-tailed)	.	.001	.001
	N	50	50	50
	Pearson Correlation	.544(**)	1	.650(**)
	Sig. (2-tailed)	.001	.	.001
	N	50	50	50
	Pearson Correlation	.568(**)	.650(**)	1
	Sig. (2-tailed)	.001	.001	.
	N	50	50	50

** Correlation is significant at the 0.01 level (2-tailed).

CORRELATION MATRIX OF LE MD



Coefficients(a)

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.

		B	Std. Error	Beta		
1	(Constant)	-2.542	.850		-2.992	.004
	F_It	.666	.103	.683	6.483	.000

a Dependent Variable: H_It

Y = -2.542 + 0.666X, r = 0.683, p<0.001, n= 50

Coefficients(a)

		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta		
	(Constant)	-3.931	.839		-4.684	.000
	O_It	-.673	.136	-.580	-4.937	.000

a Dependent Variable: H_It

Y = 3.931- 0.673X, r = - 0.581, p<0.001, n= 50

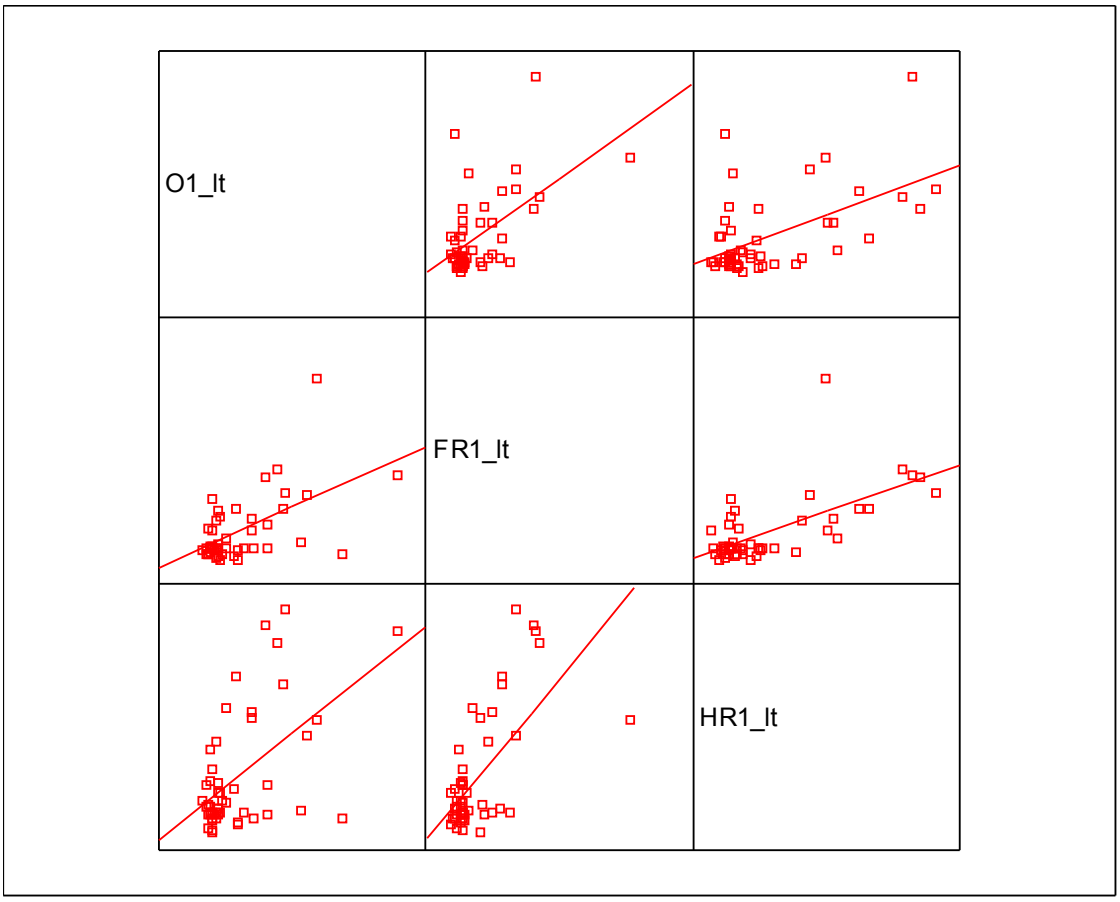
Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.613	.764		.803	.426
	F_It	-.545	.092	-.648	-5.901	.000

a Dependent Variable: O_It

Y = 0.613- 0. 545X, r = - 0.648, p<0.001, n= 50

CORRELATION MATRIX OF LE LV/PSD



Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.641	.650		.986	.329
	FR1_lt	.561	.095	.650	5.928	.000

a Dependent Variable: HR1_lt

Y = 0.641+0.561X, r = 0.650, p<0.001, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.420	.504		4.804	.000
	O1_lt	.094	.021	.544	4.486	.000

a Dependent Variable: HR1_lt

Y = 2.420+0.094X, r = 0.544, p<0.001, n= 50

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.616	4.077		-.151	.881
	FR1_lt	2.843	.594	.568	4.785	.000

a Dependent Variable: O1_lt

Y = -0.616 + 2.84X, r = 0.568, p<0.001, n= 50

TIME DURATION TO PERFORM TEST:-

The average time taken to perform the was taken. The average time to perform in Right eye was 2.272 minutes, 8.087 minutes and 3.8062 minutes for Octopus,Humphrey and Frequency Doubling Technology respectively. The average time to perform in left eye was 2.2918 minutes, 8.08 minutes and 3.696 minutes for Octopus,Humphrey and Frequency Doubling Technology respectively.

Time taken to perform the test

Name of perimetry	Right Eye	Left Eye
Octopus	2.272	2.2918
Humphrey	8.087	8.08
Frequency Doubling Technology	3.8062	3.696

DISCUSSION

DISCUSSION:-

Octopus Mean Deviation of right eye significantly and negatively correlated with Humphrey and Frequency Doubling Technology Perimetry. Similarly Humphrey Mean Deviation significantly and positively correlated with Frequency Doubling Technology Perimetry. Since $p < 0.001$ the mean deviation of 3 perimeters are statistically correlated with each other.

Right eye Loss variance of Octopus significantly and positively correlated with Humphrey and Frequency Doubling Technology Perimetry pattern standard deviation. Similarly Humphrey pattern standard deviation significantly and positively correlated with Frequency Doubling Technology Perimetry. Since $p < 0.05$ the loss variance/ pattern standard deviation of 3 perimeters are statistically correlated with each other.

Octopus Mean Deviation of left eye significantly and negatively correlated with Humphrey and Frequency Doubling Technology Perimetry. Similarly Humphrey Mean Deviation significantly and positively correlated with Frequency Doubling Technology Perimetry. Since $p < 0.001$ the mean deviation of 3 perimeters are statistically correlated with each other.

Left eye Loss variance of Octopus significantly and positively correlated with Humphrey and Frequency Doubling Technology Perimetry pattern standard deviation. Similarly Humphrey pattern standard deviation significantly and positively correlated with Frequency Doubling Technology Perimetry. Since $p < 0.001$the loss variance/ pattern standard deviation of 3 perimeters are statistically correlated with each other.

The average time to perform the test is lesser in Octopus perimeter for both eyes.

SUMMARY:-

From the above discussion it is evident that visual field plotting with Octopus by TOP

programme is shortest. Plotting the visual field using Octopus takes minimum time – 2.27 minutes/ eye, while Humphrey takes 8.08 minutes/eye and FDT -3.7 minutes/eye.

In the established glaucoma cases the global indices is arrived at doing visual field plotting with all 3 perimeters are comparable.

In early glaucoma cases the defects are better recognized by using FDT. Since the sample size is small correlation was not calculated. It could be taken that considering early detection of fields and portability of the machine, FDT could be recommended for glaucoma screening programmes.

CONCLUSION:-

1. Visual field plotting by Octopus TOP takes lesser time.
2. In established glaucoma patients the global indices of 3 perimeters are comparable.
3. FDT can be used for screening purpose to detect early glaucoma changes.

PROFORMA

NAME: OP/IP NO:

AGE: GLAUCOMA CL.NO:

SEX: MALE/FEMALE DATE:

OCCUPATION:

GENERAL HISTORY:

DIABETIC

HYPERTENSIVE

CARDIOVASCULAR/CEREBROVASCULAR

OTHER SYSTEMIC ILLNESS

PRIOR NON – OCULAR SURGERY

CURRENT SYSTEMIC MEDICATIONS/DRUG ALLERGIES

FAMILY HISTORY OF GLAUCOMA:

OCULAR HISTORY:

PRESENTING SYMPTOMS: DEFECTIVE VISION/FIELD DEFECT/ROUTINE SCREENING

AGE OF ONSET /DURATION OF COMPLAINTS

	RE	LE
DEFECTIVE VISION		
HEAD ACHE		
EYE PAIN		
REDNESS		
FIELD DEFECT		
COLOURED HALOS		
HISTORY OF FREQUENT CHANGE OF GLASSES		
EPISODE OF BLURRED VISION		
H/O OCULAR TRAUMA		
H/O PREVIOUS EYE DISEASES OR SURGERY		
H/O PROLONGED USE OF STEROIDS(TOPICAL/SYSTEMIC)		
PREVIOUS TREATMENT		
PRESENT TREATMENT		

EXAMINATION:

GENERAL EXAMINATION

GENERAL CONDITION:

PULSE: BP:

OCULAR EXAMINATION:

	RE	LE

VISUAL ACUITY(BY SNELLEN'S)

WITH PIN HOLE

REFRACTION

NEAR VISION

LIDS:

CONJUCTIVA:

CORNEA:

ANTERIOR CHAMBER:

IRIS:

PUPIL:

LENS:

GONIOSCOPY

SHAFFERS

INTRAOCULAR PRESSURE:

APPLANATION:

FUNDUS:

DISTANT DIRECT/+90 D LENS

DISC SIZE

- SHAPE
- MARGIN
- COLOUR

CUP:DISC RATIO

VESSELS

NEURORETINAL RIM

LAMINAR DOT SIGN

NASAL SHIFT OF VESSELS

BAYONETTING

PRESENCE OF HAEMORRHAGES

NERVE FIBRE LAYER

NORMAL/WEDGE DEFECT/DIFFUSE ATROPHY

MACULA

OTHER FINDINGS

FIELD TESTINGS

MANUAL: BJERRUM'S KINETIC

AUTOMATED PERIMETRY

- OCTOPUS 1-2-3- G_1X
- HFA II
- FREQUENCY DOUBLING TECHNOLOGY.

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KEY TO MASTER CHART:-

OR – RIGHT EYE MEAN DEVIATION OF OCTOPUS

HR- RIGHT EYE MEAN DEVIATION OF HUMPHREY

FR- RIGHT EYE MEAN DEVIATION OF FDT

O1R- RIGHT EYE LOSS VARIANCE OF OCTOPUS

H1R- RIGHT EYE PATTERN STANDARD DEVIATION OF HUMPHREY

F1R - RIGHT EYE PATTERN STANDARD DEVIATION OF FDT

OL – LEFT EYE MEAN DEVIATION OF OCTOPUS

HL- LEFT EYE MEAN DEVIATION OF HUMPHREY

FL- LEFT EYE MEAN DEVIATION OF FDT

O1L- LEFT EYE LOSS VARIANCE OF OCTOPUS

H1L- LEFT EYE PATTERN STANDARD DEVIATION OF HUMPHREY

F1L - LEFHT EYE PATTERN STANDARD DEVIATION OF FDT

OTR – TIME DURATION TO PERFORM THE TEST BY OCTOPUS IN RIGHT EYE

HTR- TIME DURATION TO PERFORM THE TEST BY HUMPHREY IN RIGHT EYE

FTR- TIME DURATION TO PERFORM THE TEST BY FDT IN RIGHT EYE

OTL- TIME DURATION TO PERFORM THE TEST BY OCTOPUS IN LEFT EYE

HTL- TIME DURATION TO PERFORM THE TEST BY HUMPHREY IN LEFT EYE

FTL- TIME DURATION TO PERFORM THE TEST BY FDT IN LEFT EYE